

FCC §1.1310 & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power*		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
2.4G Wi-Fi	2412-2462	-1.27	0.75	21.5	141.25	20	0.0211	1.0
BLE	2402-2480	-1.27	0.75	12.5	17.78	20	0.0027	1.0
GSM850	824-849	-1.72	0.67	25.81	381.07	20	0.0508	0.549
GSM1900	1850-1910	-3.26	0.47	22.81	190.99	20	0.0179	1.0
WCDMA B2	1850-1910	-3.26	0.47	25	316.23	20	0.0296	1.0
WCDMA B4	1710-1755	-6.14	0.24	25	316.23	20	0.0151	1.0
WCDMA B5	824-849	-1.72	0.67	25	316.23	20	0.0421	0.549
LTE B2	1850-1910	-3.26	0.47	25	316.23	20	0.0296	1.0
LTE B4	1710-1755	-6.14	0.24	25	316.23	20	0.0151	1.0
LTE B5	824-849	-1.72	0.67	25	316.23	20	0.0421	0.549
LTE B7	2500-2570	2.25	1.68	25	316.23	20	0.1057	1.0
LTE B12	699-716	-2.93	0.51	25	316.23	20	0.0321	0.466
LTE B13	777-787	-0.68	0.68	25	316.23	20	0.0541	0.518
LTE B25	1850-1915	-3.26	0.47	25	316.23	20	0.0296	1.0
LTE B26	814-824	-1.72	0.78	25	316.23	20	0.0491	0.543
LTE B26	824-849	-1.72	0.67	25	316.23	20	0.0421	0.549
LTE B38	2570-2620	2.25	1.68	25	316.23	20	0.1057	1.0
LTE B41	2496-2690	2.25	1.68	25	316.23	20	0.1057	1.0

Note:

1. The devices contain certified WWAN Module, FCC ID: XMR201903EG25G
2. The tune-up power provided by the applicant.

The WWAN and BT/WiFi can transmit simultaneously: the worst case as below:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$$=0.0211/1.0+0.1057/1.0$$

$$=0.1268 < 1.0$$

Result: The device meet MPE at 20 cm distance